

Dissecting eyes - hints and tips

Hands on activities such as carrying out an eye dissection are extremely engaging and exciting for learners. Even a demonstration carried out by their teacher can bring the most attractive illustrations of the eye to life for learners and aid their understanding of its anatomy and physiology. In our view, it is a pity that many teachers and science departments have shied away from carrying out eye dissections with their classes in the belief that ‘eyes are banned’.

Following the recent SSERC Bulletin article [1], which provided guidance to schools on complying with current legislation on the acquisition and disposal of animal by-products such as eyes, the biology team at SSERC believe that an article on carrying out an eye dissection is timely.

The Code of Practice, *Materials of Living Origin* [2], which can be accessed from the SSERC website (www.sserc.org.uk), has recently been reviewed, updated and issued to all Member schools. This Code of Practice contains health and safety advice on the use of animal material, which teachers should be aware of prior to carrying out dissection work with learners.

The Code of Practice states [2], “Only materials fit for human consumption obtained from abattoirs, butchers or fishmongers may be used for the purpose of dissection or experimentation”. There is further specific advice [1, 2] on the acquisition and disposal of nervous tissue (including eyes) from cattle, sheep and goats. The Code of Practice [2] also outlines methods for disposal of materials used for dissection.

Preserved eyes can be purchased from Blades Biological (www.blades-bio.co.uk).

The fresher the eyes, the easier they will be to cut. Often, however, there is no alternative to using eyes which have been purchased in advance and frozen, or purchasing eyes which have been preserved in chemicals. It should be noted that freezing or preserving eyes in chemicals can cause the lenses to become opaque.

It is best to get eyes with muscle and fat still attached as these provide useful teaching points.

Health and Safety considerations

Who should take part?

Sensitivity to pupils’ feelings about observing or carrying out a dissection is essential. According to the Code of Practice [2], “No pupils should be required to take part in or observe any dissection procedure if they do not wish to do so”.

Which instruments are best to use?

The Code of Practice suggests that the use of scissors rather than scalpels for any dissection will reduce the incidence of accidental cuts. We would suggest that, apart from the initial small incisions through the cornea and sclerotic coat, which are most easily done with a scalpel, scissors should be used for eye dissection. (See paragraph below on the question of eye protection).

Should gloves be worn?

Prior to, and on the completion of any dissection work hands should be washed thoroughly with soap and warm water. Any cuts or grazes should be covered with waterproof dressings.

The question of gloves is always a tricky one to address. Because they may affect dexterity, the use of disposable gloves might pose a hazard, increasing the risk of accidental cuts from a scalpel or scissors, and therefore is not deemed necessary. However, the Code of Practice [2] does state that disposable gloves should be available to pupils who wish to use them. If there are several cuts or grazes on the hands, gloves should be worn and extra care advised.

Is eye protection necessary?

It should not be necessary to wear safety glasses. However, the sclerotic coat of an eye is very tough and making the initial incision through this requires some pressure. A case was recently reported to SSERC where the contents of an eye being dissected spurted in to the eye of a pupil. Teachers may decide to have learners wear safety glasses for this stage of the procedure, or teachers may make the initial incision with a scalpel and learners can then use scissors to complete cutting round the sclerotic coat. Depending on

the age of the learners and nature of the group, it may be sufficient to point out this hazard and to advise caution.

The practical work

Setting the scene

Starting with the familiar is important when introducing any new concept, or subject matter. Before handling the eyes to be dissected, learners should be able to identify the *pupil*, *iris* and *sclerotic coat* (or *sclera*) of another person's eyes, or their own eyes in a mirror. This is a good time to point out and discuss the roles of eye lashes, tears, tear glands and tear ducts. It is also interesting to note how well protected the eyes are by their bony sockets and how little of the eye is actually visible.

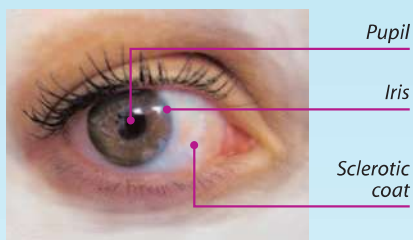


Figure 1 - External view of a human eye.

Observation and identification of the parts of an eye in section is a useful next step. A frozen eye can be sawn longitudinally so that each part can be related to a typical text book diagrammatic representation of an eye.

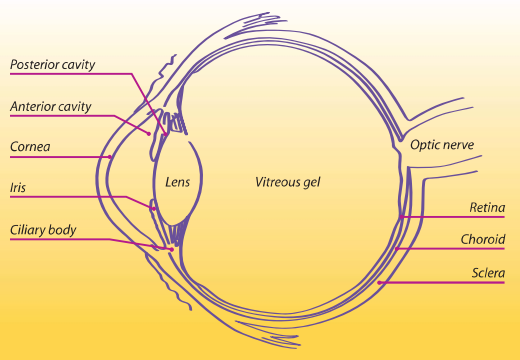


Figure 2 - Eye diagram [3].

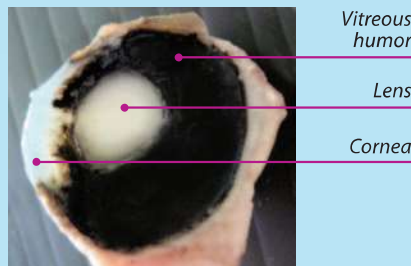


Figure 3 - Longitudinal section of a frozen bull's eye.

The dissection

Learners should examine the outside of the eye and identify the *sclerotic coat* (*sclera*), the transparent *cornea* at the front (although this may appear to be cloudy). It may be possible to look through the *cornea* to see the *iris* and *pupil* and to note the shape of the pupil.



Figure 4 - Bull's eye viewed from the front.

On further examination of the outside of the eye, the protective function of the fatty tissue can be noted. This is also a good opportunity to discuss the function of the *extraocular muscles*. The movement of these muscles is voluntary; often and normally done without thinking. Learners could consider the different ways in which eyes need to move. For example, in activities like reading the movement of the muscles needs to be precise and fast.

The fat and muscle can now be cut away revealing the optic nerve at the back of the eye.



Figure 5 - Cut away the fat and muscle.

Holding the eye firmly in place with tongs, a scalpel can be used to very carefully make a small incision in the cornea allowing the clear liquid (*aqueous humor*) to run out. This liquid is mostly water and maintains the shape of the cornea.

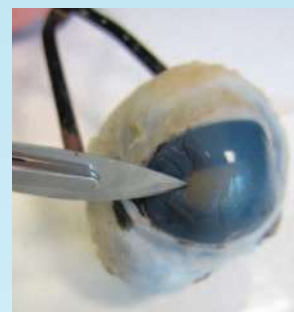


Figure 6 - Make an incision in the cornea.

The next step is to make an incision in the sclerotic coat in the middle of the eyeball. Great care is needed at this stage as it will take some pressure on the scalpel to cut through this tough protective layer (see Health and Safety considerations above).



Figure 7 - Carefully make an incision through the sclerotic coat.

It should now be easy to cut through the sclerotic coat all the way round the eye using scissors.



Figure 8 - Cut all the way round.

Covering the front half of the eye is the transparent *cornea*. Learners will notice that this is a tough, protective layer. Together with the lens and the *aqueous humor* in the *anterior chamber*, the cornea has an important role in the refraction of light. At this stage it becomes very obvious that the pupil is a hole which lets light in to the eye and is covered by the cornea.



Figure 9 - The pupil is a hole in the iris and is protected by the cornea.

It should be possible to pull the iris away in one piece from the cornea. The pupil is the hole in the centre of the iris. The iris controls the size of the pupil.



Figure 10 - The iris separated from the cornea.

The back of the eye is filled with a clear jelly, the *vitreous humor*, which helps maintain the shape of the eyeball. The lens is a harder jelly lump which is easily separated from the vitreous humor.

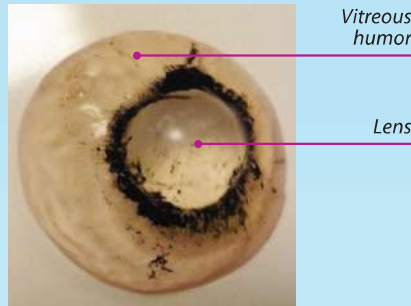


Figure 11 - Vitreous humor and lens.

This is also a good opportunity to discuss 'accommodation' with learners. Accommodation involves the shape of the lens being changed by the action of the *ciliary body (ciliary muscle)* in order to focus on objects at varying distances. The ciliary body is a ring of smooth muscle fibres that holds the lens in place and also produces aqueous humor.

Once the lens has been removed its magnifying effect can be seen by placing it on a piece of print.



Figure 12 - The lens will magnify print.

Now that the vitreous humor has been removed from the back of the eye it is possible to observe the blood vessels that form part of a thin fleshy layer - the *retina*.



Figure 13 - The retina.

Light entering the eye is focussed on the retina. The cells of the retina convert light energy to electrical impulses which travel to the brain via the optic nerve.

The retina can be moved around but is prevented from being removed by its attachment at the *blind spot*. This is the place where the nerve fibres of the retinal cells come together and enter the *optic nerve*.



Figure 14 - The retina remains attached at the blind spot.

The optic nerve is visible at the back of the eye in the area corresponding to the blind spot.

Clean-up and disposal

Guidance on disposal of the eye dissection material is given in *Materials of Living Origin* [2].

Any instruments used in the dissection should be cleaned using hot water and detergent.

'Avoid the use of detergents, such as those based on chlorine, or *Virkon*, which can corrode instruments. Autoclaving before re-use is the preferred method' [2].

Hands should be washed thoroughly with warm water and soap. ◀

References

- [1] Dissecting bulls' eyes (2012), *SSERC Bulletin*, **240**, 11.
- [2] Third editions of Codes of Practice published (2012), *SSERC Bulletin*, **240**, 12. Copies of the Code of Practice are available via the Biology Health & Safety pages on the SSERC website www.sserc.org.uk
- [3] Free Anatomy Clipart Images - available at www.cksinfo.com/medicine/anatomy/index.html (accessed 20th September 2012).